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Successful Surgical Treatment of Massive Pulmonary Embolization

Report of a Case and Review of the Literature

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ALTHOUGH TRENDELENBURG first described his procedure for pulmonary embolectomy in 1908,[18] the first successful Trendelenburg procedure was not reported until 1924.[12] Up to 1961, only 23 successful Trendelenburg procedures had been reported in the world's literature[5] and in most centers the results were disappointing.[16]

The first successful pulmonary embolectomy performed with the aid of cardio-pulmonary bypass was reported by Cooley and Beall in 1961,[6] although Sharp[14] apparently performed the first successful procedure but did not report it until one year later. Up to 1965, there had been over 30 case reports of successful pulmonary embolectomy using cardio-pulmonary by-pass.[13]

There are an estimated 47,000 deaths annually from pulmonary embolization in the United States.[7] In a review of autopsy findings when presumably healthy persons died suddenly, 26 cases of massive pulmonary embolization were found, five of them in women who died in the first trimester of pregnancy.[4] The purpose of this paper is to present a report of a case and to review the pertinent principles in the management of patients.

Submitted 18 May 1967.

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Report of a Case

A 27-year-old white woman was admitted to St. Mary's Long Beach Hospital on 18 November 1966. Seven days earlier, a cesarean hysterectomy had been performed at another hospital, and "large varicose veins" were noted on the right ovary and fallopian tube. The patient was discharged from the hospital, completely asymptomatic, three days before the present admission. About 24 hours before admission she complained of mild shortness of breath, dizziness and lightheadedness. She did not have cough or hemoptysis. Approximately nine hours before admission she became acutely short of breath and complained of left precordial pain radiating to the left side of the neck. Later she noticed pain in the right side of the neck and right shoulder which was related to respiration. She had had no antecedent abdominal pain or swelling of the legs. The past history was completely negative for cardio-respiratory or peripheral vascular disease.

The patient was acutely ill, dyspneic, pale and cyanotic, but cheerful and alert. The pulse rate was 140, and the blood pressure 90/60 mm of mercury. The second heart sound was loudest at the second left intercostal space. There was no right ventricular lift.

An x-ray film of the chest showed enlargement of a pulmonary artery segment of the cardiac silhouette. The descending right pulmonary artery was prominent. No abnormal parenchymal or pleural densities were noted. An electrocardiogram revealed a vertical heart at $+90°$, with inverted T waves in leads V_1 and V_2. Hemoglobin was 10.7 gms per 100 ml of blood. Leukocytes numbered 12,200 per cu mm. Results of urinalysis were within normal limits.

Intravenous administration of heparin was begun, and approximately two hours following admission a metaraminol drip was started to maintain the blood pressure. The patient continued cyanotic despite constant administration of oxygen. A macroaggregated albumin-iodine^{131} lung scan (Figure 1) showed diminished radioisotope distribution in the right middle and lower lung fields. Multiple areas of decreased activity were also detected on the left, indicating a bilateral perfusion deficit. A

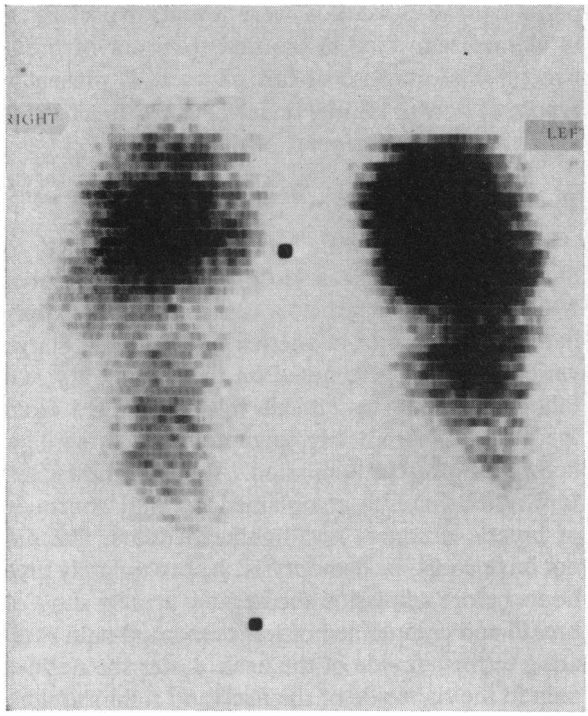

Figure 1.—Lung scan demonstrating extensive bilateral perfusion deficit.

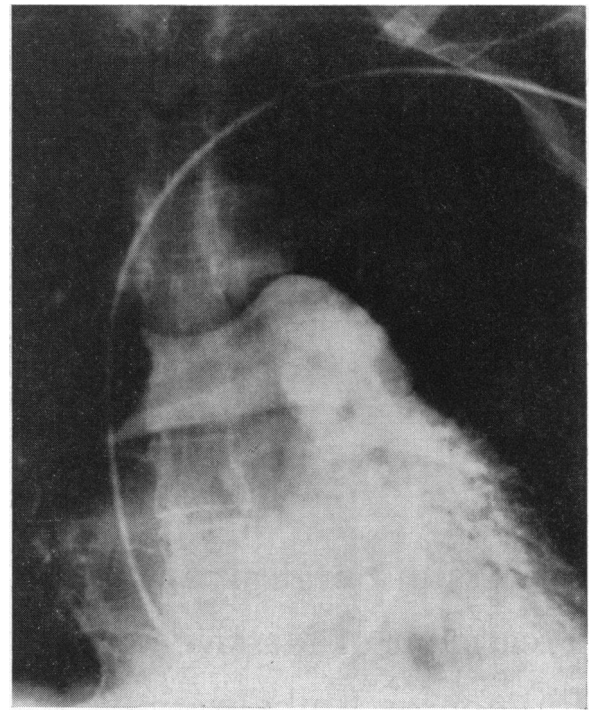

Figure 2.—Pulmonary angiography demonstrating severe bilateral pulmonary artery obstruction.

pulmonary angiogram (Figure 2) confirmed the presence of bilateral thrombo-embolic disease. A large concave filling defect was noted at the bifurcation of the right main pulmonary artery. Obstruction was also seen at the level of the distal left main pulmonary artery. Intra-luminal thrombi were noted extending into the lobar pulmonary arterial branches bilaterally. The right ventricular pressure was 40/20 mm of mercury.

On the night of admission, with the patient under local anesthesia, venous and arterial monitoring catheters were established, the right femoral artery and vein were isolated and partial cardiopulmonary by-pass was begun with use of a disposable Travenol bag.* Her color and vital signs immediately improved. General anesthesia was then induced and a median sternotomy incision was made. After total by-pass was established, venus return suddenly diminished. A large thrombus was found occluding the inferior vena cava cannula. After its removal and the reestablishment of adequate venous return, the main pulmonary artery was opened longitudinally and the thrombi pictured in Figure 3 were removed. The pericardium was closed loosely. Simultaneous with the thrombectomy, a clip was placed on the inferior vena cava and both ovarian veins were ligated.

The patient did well postoperatively and was maintained with heparin. An x-ray film of the chest showed striking reduction in the size of the pulmonary artery segment and some reduction of the right pulmonary artery.

On 28 November the patient again complained of intermittent chest pain and dyspnea. An inferior venacavagram revealed a functioning and patent plication. A typical appearing configuration[3] was seen at the plication site. There was no evidence of trapped thrombus, occlusion or breakdown of the plication. She continued to do poorly in spite of anticoagulation. On 5 December, chest radiography revealed the interval development of an abnormal retrocardiac density compatible with left lower lobe consolidation. Blunting of the right costophrenic sulcus was seen. The cardiac silhouette had enlarged considerably. Significant pulsus paradoxicus and diminished heart tones were noted clinically. Pulmonary and right atrial angiography was performed. The films were interpreted as showing delayed opacification and delayed flow to the left lower lobe (Figure 4), and a definite pericardial effusion.

The previous operative site was reopened and a large accumulation of sanguinous pericardial effusion was evacuated. Vital signs immediately

*Travenol Laboratories, Morton Grove, Ill.

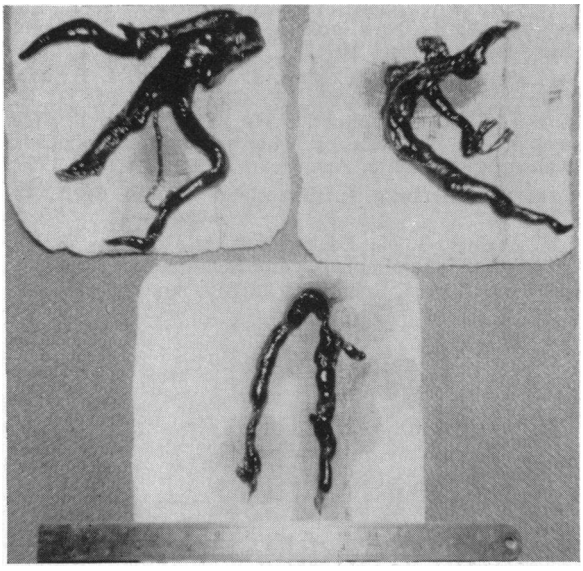

Figure 3.—Thrombi removed from right (top left) and left (top right and bottom) pulmonary arteries.

improved. After considerable debate, exploration of the left pulmonary artery was decided upon in view of the preoperative angiogram, and cardio-pulmonary by-pass was effected. No thrombi were found, however. The left lower lobe of the lung was described as "stiff and discolored." The patient had an uneventful recovery, and was discharged 17 December. When she was last seen, 18 April 1967, an x-ray film of the chest and an electrocardiogram were within normal limits and she was completely asymptomatic.

Discussion

It has been stated that any patient with acute cor pulmonale, shock and cyanosis, secondary to pulmonary embolization persisting for one to two hours, will die without surgical intervention.[18] Sautter and coworkers[15] have reported two cases in which patients with massive pulmonary embolization without clinical shock survived without surgical intervention. Both of these patients subsequently had normal pulmonary arteriograms. Fred and Axelrad[9] demonstrated angiographic clearing in seven patients with emboli restricted to lobar and segmental branches. Again, none of these patients was in clinical shock. Houk and coworkers,[11] on the other hand, reported a well studied case of chronic pulmonary hypertension with elevated pulmonary vascular resistance and arterial desaturization subsequent to massive pulmonary thromboemboli. The patient was improved by pulmonary thrombectomy approximately five months after the

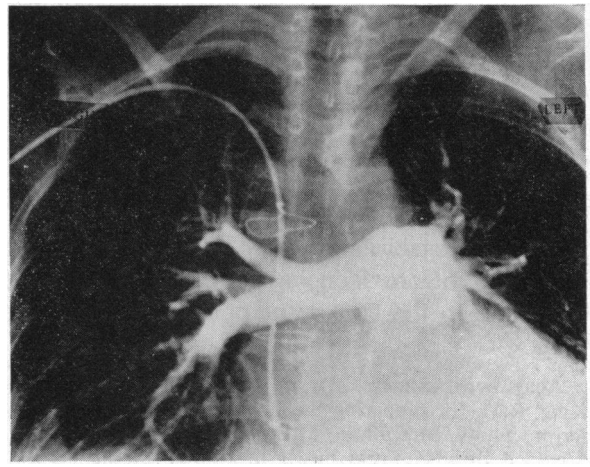

Figure 4.—Postoperative pulmonary arteriogram demonstrating delayed flow to the left lower and upper lobes.

acute embolic episode. The factors which activate lysis of pulmonary thromboemboli in some patients but not in others are not apparent. It seems, however, that patients with acute massive pulmonary embolization and clinical manifestations of shock, prolonged cyanosis or impairment of vital centers, will not survive long enough for these presumably fibrinolytic factors to operate.

The importance of establishing partial by-pass under local anesthesia before inducing general anesthesia has been emphasized by several investigators.[1,2,8,13] Ligating the pulmonary artery of dogs, Beall and coworkers[1] found that all animals died within 15 minutes of the induction of general anesthesia, whereas all animals placed on partial by-pass initially, survived for at least one hour.

In the present case the first pulmonary angiogram correlated exactly with the condition observed at operation. The chest roentgenogram at the time of admission, although abnormal, did not reflect the catastrophic intrathoracic condition that was present. There was good correlation with the initial lung scan. However, a lung scan cannot be relied upon as the only diagnostic procedure in thrombo-embolic disease.[10] Pulmonary arteriography is mandatory if pulmonary arterial operation is contemplated.[19] If necessary, cardio-pulmonary by-pass should be established before angiography.

The conditions observed in the second angiographic study in the present case were undoubtedly due to infarction of the left lower lobe from the previous embolization. Asymmetrical filling or prolongation of the arterial phase or "oligemia" is not adequate radiographic evidence of pulmonary embolization if the lungs are otherwise abnormal.[17]

Summary

A case of massive pulmonary embolization and successful treatment under cardio-pulmonary by-pass is presented. Patients presenting with the clinical picture of massive pulmonary embolization, shock and cyanosis, should be considered for emergency embolectomy following appropriate diagnostic studies. Establishing partial by-pass under local anesthesia before inducing general anesthesia is important to the success of pulmonary embolectomy.

ACKNOWLEDGMENTS. We are indebted to Mr. Thomas King, R.T., for preparing the illustrations for this manuscript. M. W. McCallum, M.D., referred the patient and provided details of the initial operation. Phillip Rothschild, M.D., performed the inferior vena caval plication.

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"Red Eye" as the Presenting Sign of Syphilis d'Emblée

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IN RARE CASES the manifestations of syphilis still challenge the physician's diagnostic skill. Following is a case in which the disease occurred without chancre (syphilis d'emblée) and the initial complaint was referable to the eye. Minimal signs of secondary syphilis, not noticed by the patient, aided in establishing the diagnosis.

Report of a Case

A 25-year-old man sought help from the emergency service of the University of California Medical Center, San Francisco, on 5 August 1964 because of acute "red eye" associated with aching and photophobia for two days. Ocular examination showed chemosis, miosis, conjunctivitis and vascular engorgement of the ciliary vessels of the left eye. Both pupils reacted to light and convergence was normal. The use of compresses and instillation of an ophthalmic solution of sulfisoxazole (Gantrisin®) were prescribed. The patient was referred to the Eye Clinic, where slit-lamp examination showed fine white granular keratinous precipitates, 3+ flare, 3+ cells, and annular posterior synechiae. No inflammation of the choroid or retina was present. The patient was instructed to use ophthalmic solutions of cyclopentolate (Cy-

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Aided by Training Grant TI AM 5372-04 from the United States Public Health Service.

Submitted 26 May 1967.

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